## Claims

- [c1] A method of making an interconnect structure comprising the steps of:

  depositing a titanium layer on an interconnect structure having one or more contact openings which expose one or more silicide regions;

  subjecting said deposited titanium layer to an in-situ plasma nitridization process;

  depositing at least one layer of titanium nitride on said in-situ plasma-treated titanium layer; and filling said contact openings with tungsten.
- [c2] The method of claim 1 wherein the silicide of said silicide regions is comprised of silicon and a metal selected from the group consisting of cobalt, nickel, titanium, tungsten, platinum and molybdenum.
- [c3] The method of claim 2 wherein said silicide is comprised of a nickel silicide.
- [c4] The method of claim 2 wherein said silicide is comprised of a cobalt silicide.
- [05] The method of claim 2 wherein said silicide is comprised of a titanium silicide.

- [c6] The method of claim 1 wherein prior to depositing said titanium layer on said interconnect structure, said interconnect structure undergoes surface cleaning.
- [c7] The method of claim 1 wherein said titanium layer is deposited on said silicon substrate by a physical vapor deposition process.
- [08] The method of claim 1 wherein said titanium layer has a thickness of between about 25Å to about 250Å.
- [c9] The method of claim 1 wherein said in-situ plasma nitridization process comprises converting all free titanium into titanium nitride in a hydrogen and nitrogen gas environment.
- [c10] The method of claim 1 wherein said in-situ plasma nitridization process is performed at a temperature from between about room temperature to about 410°C.
- [c11] The method of claim 11 wherein said in-situ plasma nitridization process is performed at a temperature from between about 325°C to about 400°C.
- [c12] The method of claim 12 wherein said in-situ plasma nitridization process is performed at a temperature of about 350°C.

- [c13] The method of claim 1 wherein said in-situ plasma nitridization process is performed for a period of from between about 5 to about 60 seconds.
- [c14] The method of claim 13 wherein said in-situ plasma nitridization process is performed for a period of from between about 5 to about 45 seconds.
- [c15] The method of claim 14 wherein said in-situ plasma nitridization process is performed for a period of about 25 seconds.
- [c16] The method of claim 1 wherein said at least one titanium nitride layer is deposited on said in-situ plasma-treated titanium layer by a chemical vapor deposition process.
- [c17] The method of claim 16 wherein said CVD process involves using a titanium-containing precursor selected from the group consisting of TDMAT, TDEAT and titanium tetrachloride.
- [c18] The method of claim 16 wherein said CVD process in-volves using a nitrogen-containing precursor of ammonia.
- [c19] The method of claim 1 wherein each of said at least one titanium nitride layer has a thickness of between about 15Å to about 100Å.

- [c20] The method of claim 1 wherein at least two layers of titanium nitride are deposited on said in-situ plasmatreated titanium layer.
- [c21] A low thermal budget MOL liner comprising a titaniumdeposited layer that has been subjected to an in-situ gas plasma nitridization process.
- [c22] The low thermal budget MOL liner of claim 21 wherein said liner has a thickness of between about 25Å to about 25Å.
- [c23] A semiconductor device having a silicide contact, comprising an interconnect structure having one or more contact openings which expose one or more silicide regions; a low thermal budget MOL liner formed above said silicide contact, said liner comprising a titanium-deposited layer that has been subjected to an in-situ gas plasma nitridization process; and one or more titanium nitride layers deposited on said low thermal budget MOL liner.
- [c24] The semiconductor device of claim 23 wherein said silicide contact is comprised of silicon and a metal selected from the group consisting of cobalt, nickel, titanium, tungsten, platinum and molybdenum.

- [c25] The semiconductor device of claim 24 wherein said silicide contact is comprised of a nickel silicide.
- [c26] The semiconductor device of claim 24 wherein said silicide is comprised of a cobalt silicide.
- [c27] The semiconductor device of claim 23 wherein said titanium-deposited layer has a thickness of between about 25Å to about 250Å.
- [c28] The semiconductor device of claim 23 wherein each of said one or more titanium nitride layers has a thickness of between about 15Å to about 100Å.
- [c29] The semiconductor device of claim 23 wherein said semiconductor device is subjected to a bulk tungsten filling step.
- [c30] The semiconductor device of claim 29 wherein said bulk tungsten filling step is performed by a CVD process.